WHAT IS CLAIMED AS NEW AND IS DESIRED TO BE SECURED BY LETTERS PATENTS OF THE UNITED STATES:

Sub A1

1. An image data processing method for processing original image data that is bit mapped in a main-scanning direction X and a sub-scanning direction Y, the method comprising:

first multiplying first linearly aligned dots in the main-scanning direction X of the original bit mapped image data by a positive integer Dy to generate Dy lines of linearly aligned dots being adjoining each other in the sub-scanning direction Y as a first group of the sub-scanning direction Y;

second multiplying second linearly aligned dots in the main-scanning direction X of the original bit mapped image data, which follow the first linearly aligned dots, by a positive integer Ry to generate Ry lines of linearly aligned dots adjoining each other in the sub-scanning direction Y as a second group of the sub-scanning direction Y; and

multiplying further following linearly aligned dots in the main-scanning direction X of the original bit mapped image data by repeating said first and second multiplying steps.

2. A method according to claim 1, further comprising:

correcting dots that have been generated by the first and second multiplying steps to reduce jagged images of the multiplied bit mapped image.

3. A method according to claim 1, further comprising:

third multiplying dots at a first position of the main-scanning direction X of the original bit mapped image data by a positive integer Dx to generate Dx dots adjoining each other in the main-scanning direction X as a first group of the main-scanning direction X;

fourth multiplying dots at a second position of the main-scanning direction X, following the first position, of the original bit mapped image data by a positive integer Rx to generate Rx dots adjoining each other in the main-scanning direction X as a second group of the main-scanning direction X; and

multiplying dots at further following positions in the main-scanning direction X of the original bit mapped image data by repeating the third and fourth multiplying steps.

4. A method according to claim 3, wherein the positive integer Dy for the sub-scanning direction Y and the positive integer Dx for the main-scanning direction X satisfy a required output image resolution, and the positive integer Ry for the sub-scanning direction Y and the positive integer Rx for the main-scanning direction X satisfy a required output magnification ratio.

5. A method according to claim 3, further comprising:

correcting dots that have been generated by the multiplying steps to reduce jagged images of the multiplied bit mapped image.

6. A method according to claim 1, further comprising:

recognizing shapes of boundaries between a black dot region and a white dot region in a region including a target dot being multiplied and dots surrounding the target dot of the bit mapped image;

generating code information corresponding to the recognized shapes;

generating corrected dot data according to the generated code information;

replacing data of which dot had been generated in the dot multiplying steps with the generated corrected dot data; and

repeating from the recognizing step to the replacing step while changing the target dot one to the other.

7. A method according to claim 3, further comprising:

recognizing shapes of boundaries between a black dot region and a white dot region of a region including a target dot being multiplied and dots surrounding the target dot of the bit mapped image;

generating code information corresponding to the recognized shapes;

generating corrected dot data according to the generated code information;

replacing data of which dot had been generated in the dot multiplying steps with the generated corrected dot data; and

repeating from the recognizing step to the replacing step while changing the target dot one to the other.

8. An image data processing method for processing original image data that is bit mapped in a main-scanning direction X and a sub-scanning direction Y, the method comprising:

first multiplying dots at a first position of the main-scanning direction X of the original bit mapped image data by a positive integer Dx so as to generate Dx dots adjoining each other in the main-scanning direction X as a first group of the main-scanning direction X;

second multiplying dots at a second position of the main-scanning direction X, following the first position, of the original bit mapped image data by a positive integer Rx to generate Rx dots adjoining each other in the main-scanning direction X as a second group of the main-scanning direction X; and

multiplying dots at further following positions in the main-scanning direction X of the original bit mapped image data by repeating the first and second multiplying steps.

9. A method according to claim 8, further comprising:

correcting dots that have been generated by the first and second multiplying steps to reduce jagged images of the multiplied bit mapped image.

10. A method according to claim 8, further comprising:

recognizing shapes of boundaries between a black dot region and a white dot region of a region including a target dot being multiplied and dots surrounding the target dot of the bit mapped image;

generating code information corresponding to the recognized shapes;

generating corrected dot data according to the generated code information;

replacing data of which dot had been generated in the dot multiplying steps with the generated corrected dot data; and

repeating from the recognizing step to the replacing step while changing the target dot one to the other.

11. An image data processing apparatus for processing original image data that is bit mapped in a main-scanning direction X and a sub-scanning direction Y, the apparatus comprising:

a memory device configured to store a positive integer Dy for the sub-scanning direction Y and a positive integer Ry for the sub-scanning direction Y;

an image memory device configured to store the original bit mapped image in the main-scanning direction X and in the sub-scanning direction Y;

a memory control device configured to circularly and repetitively store data of linearly aligned dots in the main-scanning direction X of the original bit mapped image data in the image memory device at Dy times for linearly aligned dots in the main-scanning direction X as a first group of the sub-scanning direction Y, and at Ry times for following linearly aligned dots in the main-scanning direction X as a second group of the sub-scanning direction Y, alternatively; and

a data output device configured to output the circularly and repetitively stored data in the image memory device.

12. An apparatus according to claim 11, wherein the data output device comprises a jagged image correcting device configured to correct jagged images according to a recognition of shapes of boundaries between a black dot region and a white dot region of a region including the target dot being multiplied and dots surrounding the target dot of the bit mapped image.

13. An apparatus according to claim 12, wherein the jagged image correcting device comprises a dot sampling device configured to sample dot data in the region including the target dot being multiplied and dots surrounding the target dot of the bit mapped image, a characteristics recognizing device configured to recognize shapes of boundaries between the black dot region and the white dot region of the sampled dot data and to generate code information corresponding to the recognized shape, and a dot data output device configured to output dot data according to the generated code information.

14. An apparatus according to claim 13, wherein the jagged image correcting device comprises a count control device configured to count the circularly and repetitively read data of an identical target dot from the image memory device in the sub-scanning direction Y, and to initialize the count to zero when the count reaches the first positive integer Dy and when

the count reaches the second positive integer Ry, alternatively; and

wherein the dot data output device is further configured to output dot data according to the code information generated by the characteristics recognizing device and the count output from the count control device.

15. An image data processing apparatus for processing original image data that is bit mapped in a main-scanning direction X and a sub-scanning direction Y, the apparatus comprising:

a memory device configured to store a positive integer Dx for the main-scanning direction X and a positive integer Rx for the main-scanning direction X;

a data output device configured to repetitively output identical target dot data at Dx times as a first group of the main-scanning direction X, and repetitively output following identical target dot data at Rx times in the main-scanning direction X as a second group of the main-scanning X, alternatively.

16. An apparatus according to claim 15, wherein the data output device comprises a jagged image correcting device configured to correct jagged images according to a recognition of shapes of boundaries between a black dot region and a white dot region of a region including the target dot being multiplied and dots surrounding the target dot of the bit mapped image.

17. An apparatus according to claim 16, wherein the jagged image correcting device comprises an dot sampling device configured to sample dot data in the region including the target dot being multiplied and dots surrounding the target dot of the bit mapped image, a characteristics recognizing device configured to recognize shapes of boundaries between the black dot region and the white dot region of the sampled dot data and to generate code information corresponding to the recognized shape, and a dot data output device configured to output dot data according to the generated code information.

18. An apparatus according to claim 17, wherein the jagged image correcting device comprises a count control device configured to count the repetitively output data of an

identical target dot from the image memory device in the main-scanning direction X, and to initialize the count to zero when the count reaches the first positive integer Dx and when the count reaches the second positive integer Rx, alternatively; and

wherein the dot data output device is further configured to output dot data according to the code information generated by the characteristics recognizing device and the count output from the count control device.

19. An apparatus according to claim 15, further comprising:

an image memory device configured to store the original bit mapped image in the main-scanning direction X and in the sub-scanning direction Y;

a memory control device configured to circularly and repetitively store data of linearly aligned dots in the main-scanning direction X of the original bit mapped image data in the image memory device at a positive integer Dy times for linearly aligned dots in the main-scanning direction X as a first group of the sub-scanning direction Y, and at a positive integer Ry times for following linearly aligned dots in the main-scanning direction X as a second group of the sub-scanning direction Y, alternatively.

20. An apparatus according to claim 19, wherein the data output device comprises a jagged image correcting device configured to correct jagged images according to a recognition of shapes of boundaries between a black dot region and a white dot region of a region including the target dot being multiplied and dots surrounding the target dot of the bit mapped image.

21. An apparatus according to claim 20, wherein the jagged image correcting device comprises a dot sampling device configured to sample dot data in the region including the target dot being multiplied and dots surrounding the target dot of the bit mapped image, a characteristics recognizing device configured to recognize shapes of boundaries between the black dot region and the white dot region of the sampled dot data and to generate code information corresponding to the recognized shape, and a dot data output device configured to output dot data according to the generated code information.

22. An apparatus according to claim 21, wherein the jagged image correcting device comprises a count control device configured to count the circularly and repetitively read data of an identical target dot from the image memory device in the sub-scanning direction Y as a Y count, and to initialize the count to zero when the count reaches the positive integer Dy and when the count reaches the positive integer Ry, alternatively, and to count the repetitively output data of an identical target dot from the image memory device in the main-scanning direction X as an X count, and initialize the X count to zero when the count reaches the positive integer Dx and when the count reaches the positive integer Rx, alternatively; and

wherein the dot data output device is further configured to output dot data according to the code information generated by the characteristics recognizing device and the Y count and the X count output from the count control device.

23. An image data processing apparatus for processing original image data that is bit mapped in a main-scanning direction X and a sub-scanning direction Y, the apparatus comprising:

means for storing a positive integer Dy for the sub-scanning direction Y and a positive integer Ry for the sub-scanning direction Y;

means for storing the original bit mapped image in the main-scanning direction X and in the sub-scanning direction Y;

means for controlling the image storing means to circularly and repetitively store data of linearly aligned dots in the main-scanning direction X of the original bit mapped image data in the image storing means at Dy times for first linearly aligned dots in the main-scanning direction X as a first group of the sub-scanning direction Y, and at Ry times for second linearly aligned dots, following the first linearly aligned dots, in the main-scanning direction X as a second group of the sub-scanning direction Y, alternatively; and

means for outputting the circularly and repetitively stored data in the image storing means.

24. An image data processing apparatus for processing original image data that is bit mapped in a main-scanning direction X and a sub-scanning direction Y, the apparatus comprising:

means for storing a positive integer Dx for the main-scanning direction X and a positive integer Rx for the main-scanning direction X;

means for repetitively outputting identical target dot data at Dx times as a first group of the main-scanning direction X, and repetitively output following identical target dot data integer Rx times in the main-scanning direction X as a second group of the main-scanning direction X, alternatively.

25. An image data processing apparatus for processing original image data that is bit mapped in a main-scanning direction X and a sub-scanning direction Y, the apparatus comprising:

means for storing a positive integer Dy for the sub-scanning direction Y, a positive integer Ry for the sub-scanning direction Y, a positive integer Dx for the main-scanning direction X, and a positive integer Rx for the main-scanning direction X;

means for storing the original bit mapped image in the main-scanning direction X and in the sub-scanning direction Y;

means for controlling the image storing means to circularly and repetitively store data of linearly aligned dots in the main-scanning direction X of the original bit mapped image data in the image storing means at Dy times for first linearly aligned dots in the main-scanning direction X as a first group of the sub-scanning direction Y, and at Ry times for second linearly aligned dots, following the first linearly aligned dots, in the main-scanning direction X as a second group of the sub-scanning direction Y, alternatively; and

means for repetitively outputting first identical target dot data at Dx times as a first group of the main-scanning direction X, and repetitively outputting second identical target dot data, following the first identical target dot data, at Rx times in the main-scanning direction X as a second group of the main-scanning direction X, alternatively.